

Preventing Secondary Brain Injury by Early Detection of Cerebral Bleeding and Edema

Completed Technology Project (2013 - 2014)



Project Introduction

The goal of this project was to 1) improve the Cerebrotech Intracranial Fluid Monitor clinical prototype device design and 2) establish human feasibility through clinical trials. Both objectives have been achieved. The prototype was improved by 1) redesigning the mechanical patient interface, 2) improving the electronics to maximize signal-to-noise ratio, and 3) developing algorithms to correlate the intracranial fluid volume (ICF) measurements to intracranial pressure (ICP) measurements on patients in the ICU with severe brain injuries. The study results demonstrate that ICF measurements correlate linearly with ICP in patients exhibiting good intracranial compliance. And, conversely, patients with poor intracranial compliance display a poor correlation of ICF to ICP. These results confirm our original hypothesis based on established neuroscience, and demonstrate the feasibility of non-invasive ICF monitoring using VIPS technology. We believe our study was the first to demonstrate the relationship of intracranial fluid volume and pressure using real-time, continuous ICP and ICF measurements in human patients with brain injury. Continued clinical research and validation is warranted.

Anticipated Benefits

There is a glaring gap in diagnosing and monitoring patients for brain edema and bleeding. At most, CT (computed tomography) and MRI (magnetic resonance imaging) only provide daily snapshots, and other probes like intracranial pressure (ICP) monitors are extremely invasive and are only used in the most serious cases. Most patients are left largely unmonitored in their hospital beds, except for periodic subjective clinical neurological exams, leaving them exposed to a risk of undetected brain edema or bleeding, until it causes a significant and detectable neurological deficit—and by then it is too late. Cerebrotech will offer a completely noninvasive device for monitoring small changes in brain edema and bleeding, which will provide a continuous and objective measure of brain fluids and ischemia at the patient's bedside. Patients include over 3 million admitted each year worldwide for stroke, traumatic brain injury, brain surgery, and other disorders that place them at high risk for clinical degradation. Early detection of adverse changes in patient condition is the key to improving outcomes and reducing cost for hospitals and payers.



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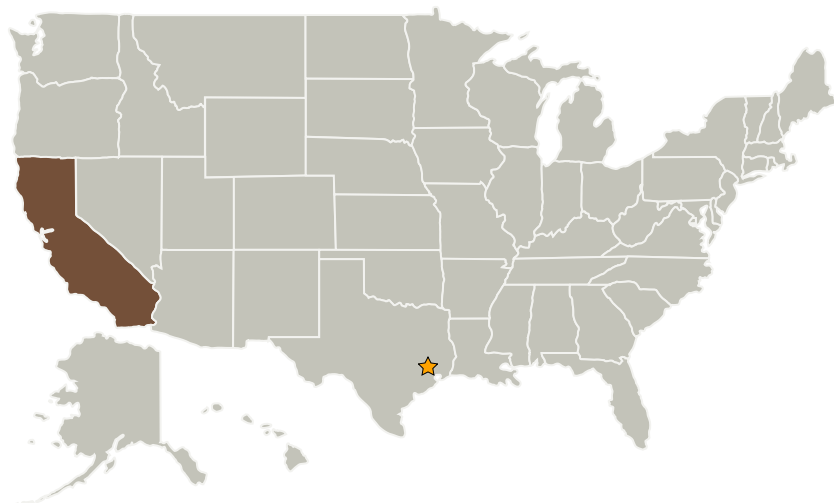
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Cerebrotech Medical Systems, Inc.	Supporting Organization	Industry	

Primary U.S. Work Locations

California

Project Transitions

April 2013: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Operations Mission Directorate (SOMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Human Spaceflight Capabilities

Project Management

Program Director:

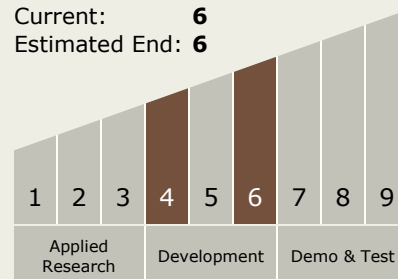
David K Baumann

Principal Investigator:

Mitchell Levinson

Technology Maturity (TRL)

Start: 4
Current: 6
Estimated End: 6



Technology Areas

Primary:

Continued on following page.

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✓ March 2014: Closed out

Closeout Summary: The goal of this project was to 1) improve the Cerebrotec h Intracranial Fluid Monitor clinical prototype device design and 2) establish human feasibility through clinical trials. Both objectives have been achieved. The prototype was improved by 1) redesigning the mechanical patient interface, 2) improving the electronics to maximize signal-to-noise ratio, and 3) developing algorithms to correlate the intracranial fluid volume (ICF) measurements to intracranial pressure (ICP) measurements on patients in the ICU with severe brain injuries. The study results demonstrate that ICF measurements correlate linearly with ICP in patients exhibiting good intracranial compliance. And, conversely, patients with poor intracranial compliance display a poor correlation of ICF to ICP. These results confirm our original hypothesis based on established neuroscience, and demonstrate the feasibility of non-invasive ICF monitoring using VIPS technology. We believe our study was the first to demonstrate the relationship of intracranial fluid volume and pressure using real-time, continuous ICP and ICF measurements in human patients with brain injury. Continued clinical research and validation is warranted.

Project Website:

<https://taskbook.nasaprs.com>

Technology Areas (cont.)

- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.3 Human Health and Performance
 - └ TX06.3.2 Prevention and Countermeasures

Target Destinations

The Moon, Mars